SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier Paper 6: Physics 2H

Specimen 2018 Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a calculator
- the Physics Equation Sheet (enclosed).

Instructions
- Answer all questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- There are 70 marks available on this paper.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.
- When answering questions 01.6 and 06.3 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname

Forename(s)

Candidate signature _____

0 1 Four students tested their reaction times using a computer program.

When a green light appeared on the screen the students had to press a key.

Table 1 shows their results.

Table 1

Student	Reaction time in s			Mean reaction time in s
	Test 1	Test 2	Test 3	
Boy 1	0.28	0.27	0.26	0.27
Boy 2	0.28	0.47	0.22	0.25
Girl 1	0.31	0.29	0.27	0.29
Girl 2	0.32	0.30	0.29	0.30

0 1 . 1 What is meant by 'reaction time' in this experiment?

[1 mark]

0 1 . 2 Boy 2 had an anomalous result in **Test 2**.

Suggest a reason why.

[1 mark]

0 1 . 3 Give **one** conclusion that can be made from the results in **Table 1**.

[1 mark]

0 1 . 4 Suggest further evidence that you could collect to support your conclusion.

[1 mark]

Reaction time is important at the start of a race.

Table 2 shows the time taken by a boy to run different distances.

Table 2

Distance in m	Time in s
100	12.74
200	25.63
800	139.46

0 1 . 5 Reaction time is more important in a 100 m race than in an 800 m race.

Explain why.

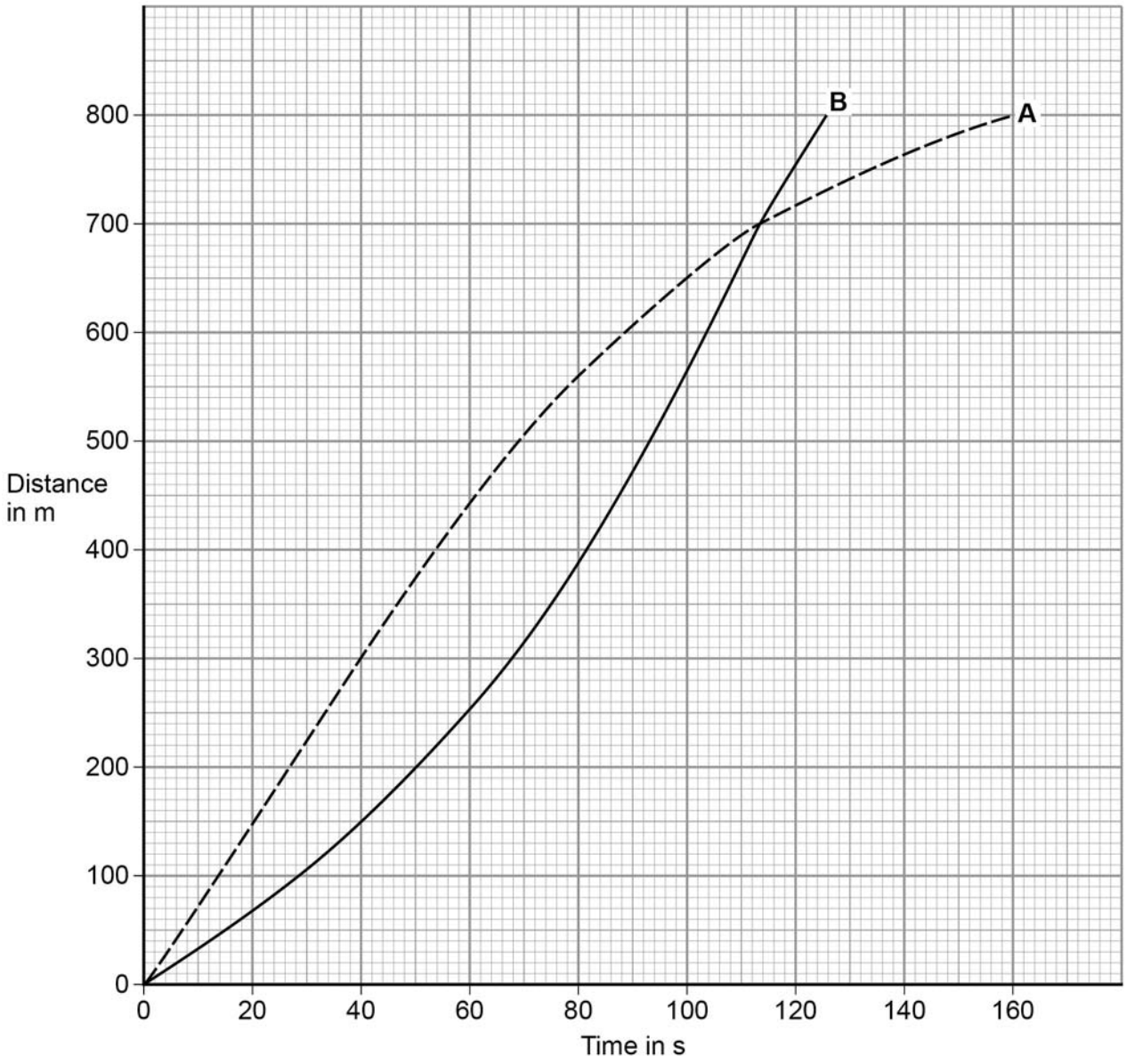
[2 marks]

Question 1 continues on the next page

Two girls, **A** and **B**, ran an 800 m race.

Figure 1 shows how the distance changed with time.

Figure 1



0 1 . 6 Compare the motion of runners **A** and **B**.

Include data from **Figure 11**.

[6 marks]

0 1 . 7 Use **Figure 1** to determine Girl **B**'s speed at 60 s.

Show how you use the graph to obtain your answer.

[3 marks]

Speed = _____ m/s

Turn over for the next question

0 2 A baby monitor has a sensor unit that transmits an image of the baby and the noises the baby makes to a monitor unit. The monitor unit then displays an image of the baby and emits the noises the baby makes.

0 2 . 1 Compare the properties of the waves that transmit images and noises from the monitor unit.

[4 marks]

0 2 . 2 The sensor unit can detect infrared and visible light.

Suggest **one** advantage of being able to detect infrared.

[1 mark]

0 2 . 3 Write down the equation that links frequency, wave speed and wavelength.

[1 mark]

Equation

0 2 . 4 The signals for the monitor unit are transmitted as electromagnetic waves with a wavelength of 0.125 m.

Wave speed of electromagnetic waves = 3×10^8 m/s

Calculate the frequency of the signal.

[3 marks]

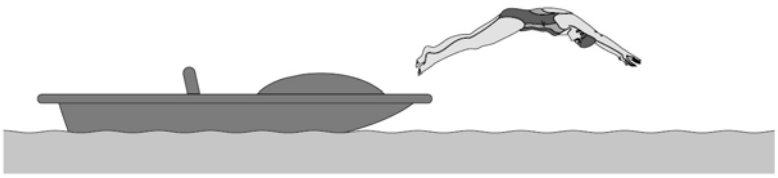
Frequency = Hz

Turn over for the next question

0 3 A swimmer dives off a boat.

Look at **Figure 2**.

Figure 2



0 3 . 1 What **two** factors determine the momentum of the swimmer?

[2 marks]

1 _____

2 _____

0 3 . 2 What is the unit of momentum?

[1 mark]

Tick **one** box.

J/s ☐

kg m/s ☐

N m ☐

m/s^2 ☐

0 3 . 3 The boat was stationary.

As the swimmer dives forwards, the boat moves backwards.

Use the idea of conservation of momentum to explain why the boat moves backwards.

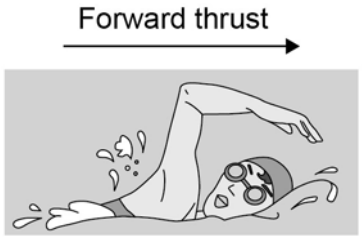
[4 marks]

0 3 . 4 Explain what would happen to the motion of the boat if there were more people on the boat when the swimmer dived off.

[2 marks]

Question 3 continues on the next page

0 3 . 5



The swimmer's speed increases as she swims away from the boat.

The swimmer has a top speed.

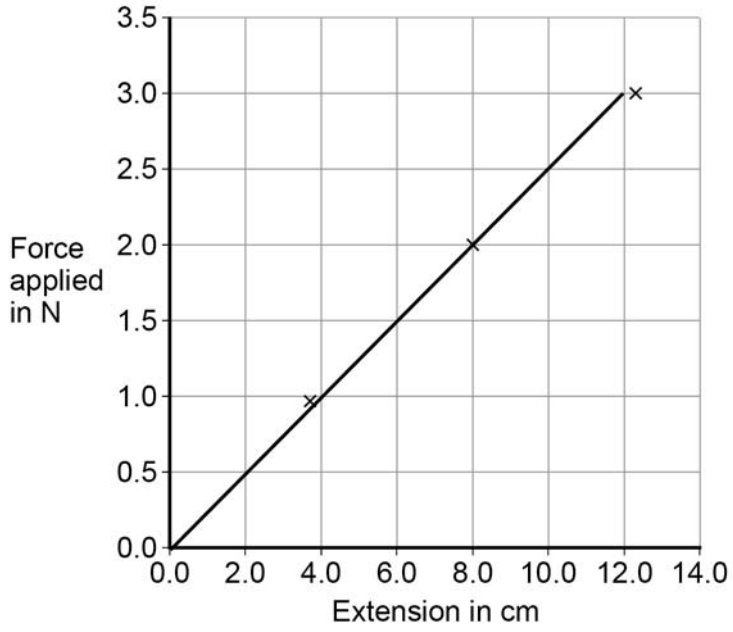
Explain why.

[5 marks]

0 4 A student changed the force applied to a spring by adding weights.

Figure 3 shows a graph of her results.

Figure 3



0 4 . 1 Write down the equation that links the force applied and extension for a spring.

[1 mark]

0 4 . 2 Identify the pattern shown in **Figure 3**.

Explain your answer.

[2 marks]

0 4 . 3 Give **one** way the student could improve her investigation.

[1 mark]

0 4 . 4 Describe the relationship between work done and elastic potential energy in stretching a spring.

[2 marks]

0 4 . 5 Draw a line on **Figure 3** to show the results for a stiffer spring.

Explain the reason for the line you have drawn.

[3 marks]

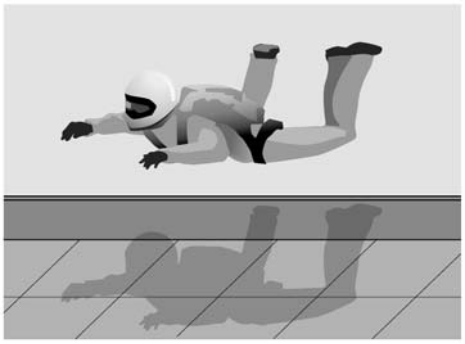
0 4 . 6 Explain what would happen to the spring if the student kept adding weights?

[2 marks]

0 5 **Figure 4** shows a skydiver training in an indoor wind tunnel.

Large fans below the skydiver blow air upwards.

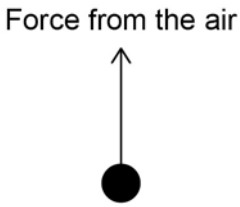
Figure 4



0 5 . 1 The skydiver is in a stationary position.

Complete the free body diagram for the skydiver.

[2 marks]



Question 5 continues on the next page

0 5 . 2 The skydiver now straightens his legs to increase his surface area.

This causes the skydiver to accelerate upwards.

Explain why straightening his legs cause the skydiver to accelerate upwards.

[2 marks]

0 5 . 3 A small aeroplane used for skydiving moves along a runway.

The aeroplane accelerates at 2 m/s^2 from a velocity of 8 m/s.

After a distance of 209 m it reaches its take-off velocity.

Calculate the take-off velocity of the aeroplane.

[3 marks]

Take-off velocity = _____ m/s

0 5 . 4 A skydiver jumps from an aeroplane.

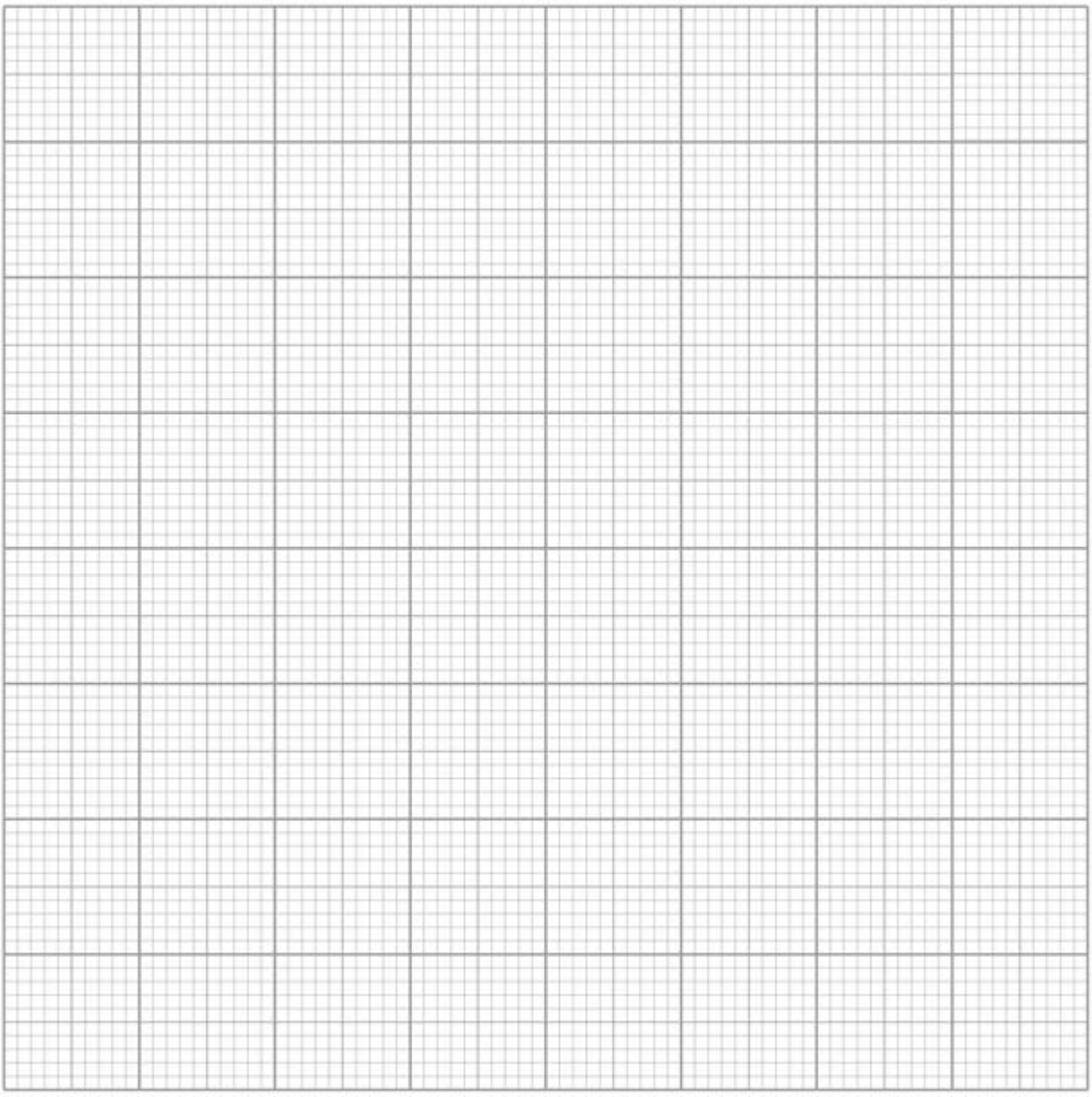
There is a resultant vertical force of 300 N on the skydiver.

There is a horizontal force from the wind of 60 N.

Draw a vector diagram on **Figure 5** to determine the magnitude and direction of the resultant force on the skydiver.

[4 marks]

Figure 5

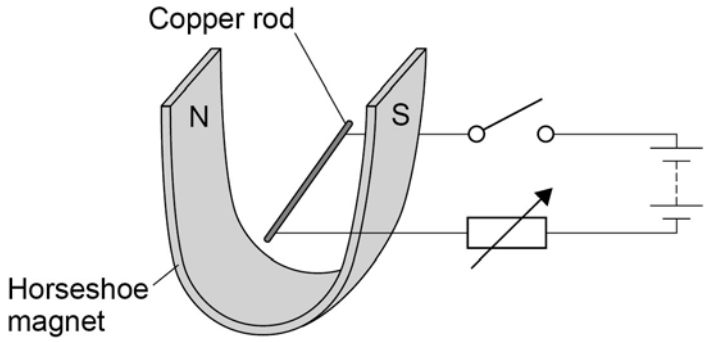


Magnitude of resultant force = _____ N

Turn over for the next question

0 6 A teacher used the equipment shown in **Figure 6** to demonstrate the motor effect.

Figure 6



0 6 . 1 Describe how Fleming's left-hand rule can be used to determine the direction in which the rod will move when the switch is closed, and state the direction.

[4 marks]

0 6 . 2 Increasing the current can increase the force acting on the copper rod.

Give **one** other way in which the size of the force acting on the copper rod could be increased.

[1 mark]

0 6 . 3 The copper rod in **Figure 6** has a length of 7 cm and a mass of 4×10^{-4} kg.

When there is a current of 1.12 A the resultant force on the copper rod is 0 N.

Calculate the magnetic flux density.

Gravitational field strength = 9.8 N/kg

[5 marks]

Magnetic flux density = _____ T

END OF QUESTIONS

There are no questions printed on this page